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AN EFFICIENT WAVELENGTH ASSIGNMENT SCHEME BASED ON PERFORMANCE METRICS FOR WDM OPTICAL NETWORKS

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ABSTRACT

Dispersion in fiber optic is wavelength dependent and it degrades the quality of service (QoS) in an optical network. To overcome this problem, proposed an efficient QoS oriented path length based wavelength assignment strategy which assign the wavelength according to the path length. In this approach, the connection requests with shorter lightpath are assigned the wavelengths having higher dispersion and the wavelengths having lesser dispersion are assigned to the lightpaths with larger distance. This strategy is the optimum choice for large size networks where the number of requests are high.

KEYWORDS: Dispersion, QoS, Routing Wavelength assignment strategy, WDM networks.

I. INTRODUCTION:

In any communication network, the measure problem relates to the allocation of network resources as buffers and link bandwidth to the different users. A restricted amount of resources has to be shared between different competing traffic flows in order to enhance the system performance. The operation of routers can be controlled in terms of packet handling to achieve a different kind of services [5]. A wavelength routed network consists of optical switches or optical cross connects interconnected by fiber links. When a connection request arrives in such kind of network, a resource reservation process finds and selects the route and wavelength to route the connection request. The process is known as routing and wavelength assignment (RWA) problem. In the wavelength routed network a connection request is realized by a light path. A light path is the optical path, established between the source node and destination node to transmit the data. In all optical networks, a light path must use the same wavelength on all the links along the selected route. This is known as wavelength continuity constraint (WCC). Wavelength continuity constraint eliminates wavelength converters at intermediate nodes this simplifies the logical network structure [2]. Various wavelength assignment strategies have been proposed in literature with wavelength conversion and without wavelength conversion [5–8]. In [9] the author had pointed out that the wavelength assignment strategy plays an important role in the network without wavelength conversion. First fit wavelength assignment strategy [10], random wavelength assignment strategy [11], most used wavelength assignment strategy [12] and least used wavelength assignment strategy [13] are the most popular assignment strategies. In [14,15] the performance of first fit strategy is compared with random, most used and least used wavelength assignment strategy and the results show that first fit strategy is better in many aspects.

In this paper one wavelength assignment strategy viz. Path length based wavelength assignment strategy has been proposed which assign the wavelength to the connection request according to the path length. The performance of proposed strategy is compared with the most commonly used wavelength assignment strategy in terms of blocking probability. Simulation results show that proposed strategy performs well for heavy loaded WDM networks.

II. EXISTING AND PROPOSED WAVELENGTH ASSIGNMENT STRATEGIES:

In order to evaluate the performance of proposed strategy and comparison with existing strategy a code has been developed in MATLAB 10.0 environment to run the simulation. It accepts input parameters such as number of nodes and links in the network, link weight, and number of available wavelengths on each link, simulation interval, arrival rate and average call holding time.

2.1. Existing wavelength assignment strategy: First fit wavelength assignment strategy:

In first fit wavelength assignment strategy all the wavelengths are numbered and the wavelength with lowest number or subscript has been given highest priority for wavelength assignment. In this strategy, a free wavelength with lowest subscript is assigned on all the links along a route to establish the connection request. If the lowest subscript wavelength is not free then the connection request is tried on second available free wavelength if it is also not free then the third wavelength is tried and so on. Thus for every connection request a free wavelength is searched according to lowest index from the available set of wavelengths. This strategy does not check the path length of a connection request. All connection requests are attempted with first fit concept only even if they have varied path length.

The algorithm is as follows:

1. For each request generated; characterized by s–d pair, do the following:
2. Find out path between the pair, using look up table, to route the information.
3. Check the availability of wavelength according to the first fit wavelength assignment strategy.
   (i) If any wavelength is assigned successfully from the available set of wavelength.
   (ii) Assign finite exponentially distributed holding time to the wavelength for connection request.
   (iii) Connection is accepted.
   (iv) If no wavelength is available, connection is rejected.

2.2 Proposed wavelength assignment strategy: Path length based wavelength assignment strategy:

In the proposed wavelength assignment strategy a wavelength is assigned to the connection request according to the path length. The connection requests with short path length are given more wavelengths as compared to the connection requests with long path length. This will lead to improved system performance in terms of blocking probability. In this strategy, two sets of wavelengths are defined viz. set 1 and set 2. In set 1 all the wavelengths are available for connection requests and in set 2 few higher indexed wavelengths are available only. For example if total available wavelengths are assumed 5 in the network then

Set 1= (λn), where n=1 : 5

Set 2= (λm), where m=4 : 5

The connection requests with short path length will be served by set1 and the connection requests with long path length will be served by set 2. Here the connection requests are categorized into two categories viz. short path length and long path length category according to path length. The connection requests with path length less than or equal to X (where X is the opted path length for a network topology) are treated as short path length category and the connection requests with path length greater than X are treated as long path length category. To determine the value of X, offline calculation of all possible s–d pairs and their path length has been done.

The algorithm of proposed strategy is as follows:

1. For each request generated; characterized by s–d pair, do the following:
2. Find out path and the path length using look up table between the s–d pair
3. If path length is less than or equal to X

(i) Check the availability of wavelength using first fit wavelength assignment strategy from set 1

(ii) If any wavelength is assigned successfully from set 1

(a) Assign finite exponentially distributed holding time to the wavelength for a connection request

(b) Connection is accepted

(iii) Else Call is blocked

4. If path length is greater than X

(i) Check the availability of wavelength using first fit wavelength assignment strategy from set 2

(ii) If any wavelength is assigned successfully from the set 2

(a) Assign finite exponentially distributed holding time to the wavelength for a connection request

(b) Connection is accepted

(iii) Else Call is blocked

III. PERFORMANCE EVALUATION:

In order to investigate the performance of proposed strategy and demonstrate that proposed strategy is better as compared to the existing strategy; system simulations have been performed in MATLAB 10.0 environment. As mentioned earlier, the essential parameters to run the simulation are number of nodes in the network, number of links in the network, link weight, number of wavelengths available per link, network load, connection requests, connection holding time and simulation interval. These parameters are initialized before running the simulation. Here a connection request will be blocked because of the unavailability of the free wavelength on links along the route. The output of the simulator is blocking probability.

Shortest path algorithm (Dijkstra's algorithm) has been considered to compute the path for each possible s–d pairs as it results in the selection of a route that uses minimum hop count or minimum number of links. Minimum number of links also results in better utilization of resources hence it reduces blocking probability. A wavelength is required to be reserved on all the links of selected route to carry the data (in case of wavelength continuity constraint). This wavelength is selected according to the wavelength assignment strategies (existing and proposed) discussed.

IV. CONCLUSIONS:

In this paper, a new wavelength assignment strategy: Path length based wavelength assignment strategy has been proposed. The performance of proposed strategy is evaluated for different values of X and compared with well-known existing strategy viz. first fit wavelength assignment strategy. Two realistic network topologies have been considered for testing of the proposed strategy. Based on the investigations undertaken, it can be concluded that the performance of proposed strategy with the optimized value of X, is much better as compared to first fit strategy in terms of blocking probability. It is clear from the simulation results that for the heavy loaded network this strategy should be given preference for achieving the better blocking performance.

REFERENCES:

1. N. Charbonneau, V.M. Vokkarane, Routing and wavelength assignment of static many cast demands over all- optical wavelength-routed WDM networks, J. Opt. Commun. Netw. 2 (7) (2010) 442–455.
2. A.M. Hamad, A.E. Kamal, Power-aware connection provisioning for all-optical multicast traffic in WDM networks, J. Opt. Commun. Netw. 2 (7) (2010) 481–495.
3. G. Mohan, G. Venkatesan, C.S. Ram Murthy, Randomized routing and wavelength requirements in wavelength routed WDM multistage, hypercube and de Bruijn networks, J. Parallel Distrib. Comput. 64 (2004) 385-399.
4. N. Sreenath, P.P. Rao, G. Mohan, C. Siva Ram Murthy, Design of survivable WDM networks for carrying ATM traffic, Computer Commun. 25 (2002) 485–500.
5. X. Chau, J. Liu, Sparse-partial wavelength conversion: converter placement and wavelength assignment, Opt. Switch. Network. 7 (2010) 66–74.
6. S. Jana, D. Saha, A. Mukherjee, P. Chaudhuri, A novel approach for assigning wavelengths in multihop WDM optical networks, Computer Commun. 31 (2008) 1751–1762.
7. H. Harai, M. Murata, H. Miyahara, Performance analysis of wavelength assignment policies in all-optical networks with limited range conversion, IEEE J. Sel. Areas Commun. 16 (1998) 1051–1060.
8. A. Wason, R.S. Kaler, Wavelength assignment algorithms for WDM optical networks, Optik 122 (10) (2010) 877–880.
9. M. Kovacevic, A. Acampora, Benefits of wavelength translation in alloptical clear-channel networks, IEEE J. Sel. Areas Commun. 14 (5) (1996) 868–880.
10. R.A. Barry, P.A. Humblet, Models of blocking probability in all-optical networks with and without wavelength changers, IEEE J. Sel. Areas Commun. 14 (1996) 858-867.
11. D. Banerjee, B. Mukherjee, Wavelength-routed optical networks: Linear formulation, resource budget trade offs and a reconfiguration study, IEEE/ACM Transactions on Networking, vol. 8, no. 9, (Oct. 2000), pp. 598–607.
12. Maheshwari, Harish, Mandhania, Sonali Sisodia "VoIP Technology: Overview and Enhancements" (MCA, I.I.P.S, D.A.V.V).
13. Setrag Khoshafian, A. Brad Baker; “Contributor A. Brad Baker”, vol. 2, no. 4, (July 2006), pp. 122-132.
14. H. Zang, J.P. Jue, B. Mukherjee, A review of routing and wavelength assignment approaches for wavelength-routed optical WDM network, Opt. Networks Mag. 1 (2000) 47–60.
15. A. Wason, R.S. Kaler, Wavelength assignment problem in optical WDM networks, IJCSNS 7 (4) (2007) 27–31.